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Report of the Rural Lines Committee

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Report of the Rural Lines Committee

The increasing demand for electric service on the farm and the many requests to the National Electric Light Association for definite information regarding this service caused the President of the Association to appoint a National Committee to make a study of the problems connected therewith. This Committee was formed in the fall of 1921 and consists of approximately thirty members selected so as to fairly represent the rural districts of the United States and Canada.

The chairmen of all Geographic Division Rural Lines Committees are members of the National Committee and are therefore fully informed with reference to the work of the National Committee.

Three well attended Committee meetings have been held at which a study was made of the various rules and reports recently published on the subject of rural electric service. The fundamentals of the various plans described in these publications have been thoroughly discussed by the Committee and the strong and weak features of each plan are set forth in this report.

Organization

Seven subcommittees were formed and they are now making special studies of the subjects described below.

1. General Rules, Regarding Rural Service.
2. Standards of Rural Line Construction.
3. Maintenance and Operating Costs of Rural Lines.
4. Rural Rates.
5. Method of Financing Rural Lines.
6. Utilization of Electric Service on the Farm and Value of Service to Farmer.
7. Development of Farm Equipment Suitable for Electric Drive.

Accurate information on these subjects is very meager. The subcommittees, however, are now engaged in collecting such information as will permit reliable conclusions to be drawn.

Size of the Field for Rural Electric Service

The last United States Census shows there are 6,448,366 farms in the United States, 6,000,000 of which are located east of a north and south line drawn along the western boundary of the Dakotas. Approximately 9,000,000 electric residential customers are being served in this country. There are therefore approximately two-thirds as many farm homes as there are homes now served with electric service. Assuming the density of population in the country is such that three customers can be served from each mile of rural distribution system, it will be seen that 2,000,000 miles of distribution lines will be required to furnish service to these 6,000,000 farms. This is more miles of distribution line than will be required to serve every home in all the cities and villages in this country.

Only a small per cent of these farms have electric service and there has not been much uniformity in

the method of supplying such service. Within the last two or three years considerable study has been given to this subject by state association committees and by the larger companies and various reports have been published. These reports which were carefully studied by the Committee will be found in the Appendix of this Report. It is thought the following discussion of the general rules included in this report will be of service in the study of the subject.

Discussion of General Rules Shown in Appendix

Definition of a Rural Consumer

There has been considerable controversy respecting what constitutes a rural consumer. The Wisconsin rules define him as "the farmer or other consumer of electrical energy who is not located within the corporate limits of any city or village, or in other territory having similar character or density of population." The Illinois rules define a rural consumer as "any consumer, except industrial light and power consumers, located outside the corporate limits of an incorporated municipality." The Indiana Public Service Commission has defined a rural consumer as "one whose premises are without the corporate limits of a municipality and one requiring an investment per customer's unit demand greater than is ordinarily required for consumers within municipalities." The contract of the Iowa Railway & Light Co. does not directly define a rural consumer but does so indirectly on an investment basis by requiring that consumers whose service necessitates an unusual investment obtain this service under their special form of contract. The rules governing extensions recently proposed in Oregon by the Northwest Division of the National Electric Light Association do not differentiate between rural and urban consumers except in the same manner as the Iowa contract. The consumer requiring an unusual investment must contribute to the cost of the extension. In defining a rural consumer one fundamental to be kept in mind is that such consumers must not be called upon to pay more than their proportionate share of the cost of service and fixed costs. Any other result will constitute discrimination. On this basis the superficial form of the Wisconsin, Illinois and Indiana rules is not good. In the case of Wisconsin the objection is largely obviated by the method of establishing the rate in individual cases because a large increase in energy consumption or a close grouping of consumers will result in the disappearance of the rural charge and the retention of the regular rates applying to the class of service involved. The same result is aimed at in the Illinois and Indiana rules, since the increased cost of the service is the specified basis of the rural charge. The lack of a definite method of establishing rates for specific cases is a weakness in these rules and should be avoided. Otherwise serious upsets may be faced in the future on the ground of discrimination. The Iowa contract

and Northwest Division Rules are nearer the true basis in this particular than the Illinois and Indiana rules. The danger in the Wisconsin rules is in the possibility of their being copied without the method of rate establishment or its equivalent.

Factors Entering Into Cost

The Wisconsin rules require an analysis of each extension proposed before any other steps are taken. In the analysis are included the costs of all labor and material in the construction of the main line, customers' transformers, services and every item entering into the service connections up to, but not including, the meter which is installed at the cost of the company in every case. To these costs an item, not exceeding 10% of material costs, is added to cover purchasing, storeroom and storeroom handling expense, and to the total figures thus reached an item of 15% is added to cover general overhead, engineering, promotion, office supervision, clerical labor, contingencies, etc. The Northwest Geographic Division Committee followed the same form in its rules suggested in Oregon. Neither the Indiana, Illinois or Iowa schemes provide anything on this subject. The most common error met with in handling any problem involving costs is that of underestimation. In the discussion of the rural service problem, some have gone so far as to state that there are no overhead costs and that the bare cost of labor and material is the final answer. No more erroneous idea can be entertained, and no set of rules that ignores all the items of cost can successfully meet the problem. What items in addition to the cost of labor and material, shall be included to cover specific values is open to discussion and will vary in different localities, but some definite values must be included.

Limitation of Service

The Wisconsin Rules provide for limitation of service dependent on the characteristics of the individual lines and the service to other consumer. No other rules cover this point. It is a question whether a limitation of this kind is good, unless it is automatically established on the basis of the cost of providing service for the increased load. An arbitrary rule of this kind is usually productive of resentment. It is probably better to establish the limit on a cost of service basis automatically or to establish rules that will bring up the subject for discussion, before any material increase in a consumer's load is made.

Service from High Voltage Transmission Lines

All rules thus far promulgated make this a matter for special consideration. Unfortunately what constitutes a transmission line has never been clearly defined. Generally this is not a matter of voltage but one of individual system conditions. A 66-kv. line may be a distribution line for one company and a 6600-volt line a transmission line for another. There is an economic factor entering into the question that may prove to be a general guide in the present state of rural line development. At the present time transformers normally classed as dis-

tribution equipment and subject to standard lists and discounts include those up to 500 kv-a. capacity and to at least 33 kv.

There is a point in voltage ratings where the small sizes of transformers needed in this class of service become too expensive to use because the service cannot stand the cost and fixed charges. The cost of protective equipment also goes beyond a figure that will permit of consideration. It is probable the cost of higher voltage service will automatically establish the limit at which the question of giving service sharply arises for special consideration. This will be due to the character of the service, and not in any way to the inherent physical characteristics of the line. The point will be determined finally by balancing the cost of lower voltage equipment and consequent losses against the cost of the higher voltage lines and requisite equipment. The limit on the lower voltage lines will be largely that of the practicable service range and the limit of the higher voltage lines will largely be based on the cost of lines and equipment required for proper service. The problem will resolve itself to equitable consideration of individual cases, rather than to strict adherence to any hard and fast general rule.

Type of Construction

The Wisconsin rules call for compliance with the minimum construction standards of the Commission. The recently developed Illinois rules contained the same requirement, while Indiana makes the requirement in a less definite way, though divided and non-utility ownership of the lines is definitely discouraged as a means to this end. The Iowa contract, while leaving the lines in private ownership for the time being provides for utility supervision of construction and maintenance with the same object in view.

Guarantee for Performance of Contract

The point is covered specifically in the rules submitted in Oregon for a minimum period of five years. A guarantee requirement is permitted under the Indiana rules. The Wisconsin rules permit discontinuance of service in case of default on the contract and the Iowa form of contract is subject to the usual procedure on default of a contract. A provision states specifically that failure to enforce the agreement or the waiving of a default shall not constitute a waiver or impair the right of either party to thereafter strictly enforce the contract. The subject of guarantees is an important one, though it seems, from the discussions that have occurred, they may not be needed in some sections of the country. All rules or contracts should provide some means of guaranteeing performance of the agreement, if in any case it is deemed necessary. If the utility owns and is responsible for the line, it is particularly necessary that some form of guarantee be allowed.

Miscellaneous

Generally the rules and contracts referred to contain the usual provisions for entry upon the property of the customer for maintenance purposes, continuity of service in cases of emergency or

abnormal conditions, and other usual requirements of any service contract pertaining to service. These are too well established to need comment. The Iowa contract (Appendix 5), however, contains a set of ten routine rules that are worth attention. Generally in the states in which Commissions have established rules the service is governed by service rules that apply to all classes of utility service. These are generally of the same character as the routine rules used with the Iowa contract.

Standards of Rural Line Construction

Too much has been said about the use of cheap construction. On the basis of unit strength and maintenance costs rural lines are no different from those in the city or urban territory. In physical aspects the lines will probably carry less mechanical load than the city lines. The problem is therefore one of cutting out excess material to reduce costs, without sacrificing strength and life.

In constructing rural lines proper regard should be given to maintenance costs and continuity of service. Where the farmer is expected to become a paying customer, it is very desirable that power service, as well as lighting service, should be used and, in order to increase the use of this type of service, it is necessary that the same standards of continuity, or as nearly the same standards as possible, be maintained on rural lines as on urban lines.

The maintenance cost of rural lines, due to this remote location and the poor condition of country roads during certain periods of the year, is many times the cost of maintaining distributing lines in urban districts, and consequently it is very important that rural lines be installed at as high, if not a higher, standard than those followed in urban districts.

Wires and crossarms should be of proper size and dimensions to comply with the National Electrical Safety Code issued by the Bureau of Standards known as Handbook No. 3, in the class and loading which apply under the conditions prescribed in this book.

The use of poles having small butt and top diameter should be discouraged as the limited life of small poles will increase materially maintenance costs. The use of poles of less than 30 ft. in height should likewise be discouraged, on account of the large number of replacements necessary where the line must be raised above the height possible on short poles due to interference from lines of other utilities, growing trees, or new driveways installed from highways to fields or farm premises. Should it be necessary to install any considerable number of poles above the ordinary height, the resultant grading of the line due to these different height poles will present a very unsightly appearance. The expense involved in such replacements will very quickly consume any construction saving which may have been made in the original line resulting from setting poles of less than 30 ft. in length.

Where lines are erected by the utility, it is to be expected a proper regard will be given to the above conditions, but where lines are erected by contractors whether maintained by the utility or at the

customer's expense, it becomes important that supervision and inspection be given by the utility during the construction of the line, so that the contractor will so design his construction as to comply with the general requirements of good service.

In constructing rural power lines careful regard should be given to the location of the right of way, both with reference to the location of trees and to the lines of other utilities occupying the highway. Where the proposed power lines will not occupy the same poles with the signal lines they should where practical be located upon the opposite side of the highway from the signal lines. Where the power lines occupy the same side of the road as signal lines it will in general be advantageous to both utilities to have these lines made joint, provided proper arrangements for equitable division of cost and maintenance can be arranged between the power and signal companies. Where possible the side of the road offering the least obstruction from trees should be used.

The transformers should in all cases be of standard type, of proper size for the customer's load, and protected by suitable types of fuse blocks and fuses together with lightning arresters. A very general criticism of farm installations is the installation of over-size transformers which materially increase the utility expense from core loss without any additional compensation. The use of fuses is an important factor as trouble, either upon the customer's premises or the transformer, will quickly isolate this section of the circuit and not interfere with the other customers connected to the same rural line.

The installation of lightning arresters, except in districts, such as the Pacific Coast, where lightning does not occur, will give added protection sufficient to compensate for their cost, both protecting the transformer from puncture and protecting the fuse from opening during storms.

The Overhead Systems Committee of this Association will publish in this year's report a summary of minimum requirements of the National Electrical Safety Code as applied to rural lines under the classification and loading shown in the report. This information will be published as a guide for contractors and utility companies engaged in furnishing rural service and should be qualified as to class and loading for different conditions and locations.

Cost of Maintaining and Operating Rural Distribution Lines

Due to the large amount of distribution system for each rural customer and to the comparatively long distance between customers, it is evident that it costs more per customer to operate distribution systems in a rural district than in urban territory.

In many districts in the United States to serve 75 rural customers it is necessary to build 25 miles of distribution line. In villages or urban territory 75 customers can be served from one to three miles of distribution system. To operate 25 miles of line it obviously costs more than to operate one to three miles of line; likewise it costs more to read 75 rural meters, scattered over a large territory, than to read

REPORT OF THE RURAL LINES COMMITTEE

75 meters in a village; and, admittedly it costs more to take care of repair jobs or line trouble in rural than in urban distribution systems. There is, however, very little accurate information on the cost of operating and maintaining rural distribution systems. This information cannot be obtained until a number of companies are willing to select a rural district served from their lines and operate such district as a small system or division distinct from the rest of the company's properties, as far as the accounting is concerned. Subaccounts will have to be set up to which will be charged all operating and maintenance costs. An analysis must be made of the rural distribution system selected showing the total investment in the lines at the time the study is started. New additions should be added to the capital investment each month, so that the total investment in the small system is up to date at all times. Meters may have to be installed to record the input kilowatt hours, the maximum 15 minute demand and the power factor. From these meters and the sum of the customers' meters can be obtained the total input, output, load factor, demand factor and power factor. The members of the Committee are making such a study in their respective companies. It is hoped that many other companies will make similar studies, so that the information available to the Committee will more nearly represent actual conditions. The study being made by one member of the committee is outlined in detail so that others may know the exact kind of information desired by the Committee.

Detailed Outline of Typical Study

The setups for the data to be tabulated monthly follow under these general headings:

- I. Analysis of Line
 1. Total Investment
 - Primary Lines
 - Secondary Lines
 - Services
 - Step-down Transformers
 - Meters
 - Substation Serving
 2. Financing of Line (Total Cost)
 - Amount Paid by Company
 - Amount Paid by Consumers
 - Per cent Paid by Company
 - Per cent Paid by Consumers
 3. Total Consumers
 - Lighting and Appliances
 - Ranges and Light
 - Motors and Light
 - Motor, Range and Light
 4. Connected Load
 - Lighting and Appliances
 - Ranges
 - Motors
 5. Step-down Transformers
 - Number
 - Kv-a. Rating
 6. Physical Characteristics
 - Length in Miles
 - Size Conductor
 - Material of Conductors
 - Phases

- Primary Voltage
 - Predominating Pole Size
 - Kind of Poles
 - Number of Line Poles
 - Average Poles per Mile
 - 7. Transformer Station Feeding Line
 - Size Kv-a.
 - Cost
- II. Operating Revenues—Operating Expenses—Net Operating Revenue**
- Operating Revenue—Total**
- Residence Lt. & Pr. (a. c.)
 - Street Lighting
 - Misc. Earnings—Forfeited Disc.
 - Misc. Earning—Allowances
- Operating Expenses—Total**
- Distribution—Total
 - Supt. of Elect. Dept.
 - Power Apportioned—Proportion Cost of Pr.
 - Operating—Total
 - Inspecting, Removing & Resetting Transformers
 - Removing and Resetting Meters
 - Inspecting and Testing Meters
 - Misc. Distribution System Oper. Labor
 - Meter Dept. Supplies & Expenses
 - Misc. Dist. System Sup. & Exp.
 - Voltage Regulation
 - Maintenance—Total
 - Maintenance of O. H. Dist. System
 - Maintenance of Transformers
 - Maintenance of Meters
 - Maintenance of Dist. System B. F. & G.
 - Shop Machinery & Tools
 - Shop Expenses
 - Utilization—Total
 - Incandescent Lamp Renewals
 - Misc. Utilization Sup. & Equip.
 - Customers' Premises Expenses
 - Maintenance of Lamps & Equip.
 - Commercial—Total
 - Collection Salaries and Commissions. Reading Meters and Delivering Bills.
 - Commissions
 - Collection Sup. & Exp.
 - Uncollectible Accounts (Res. Cr.)
 - Promotion of Business
 - General—Total
 - Salaries of General Officers
 - Salaries of General Office Clerks
 - General Office Rent
 - Misc. General Office Sup. & Exp.
 - Law Expenses Gen. (Res. Cr.)
 - Misc. General Expenses
 - Relief and Pension Assn. Exp. (Res. Cr.)
 - Public Service Commission Expenses
 - Maint. of General Office Equip.
 - Maint. of Gen. Office B. F. & G.
 - Undistributed—Total
 - Injuries and Damages (Res. Cr.)
 - Insurance (Res. Cr.)
 - Stationery, Printing & Postage
 - Operation of Stores Dept.
 - Maint. of Stores Dept. Equip.
 - Maint. of Stores Dept. B. F. & G.
 - Rent of Land, Bldgs. & other property
 - Fixed—Total
 - Depreciation (Res. Cr.)
 - Contingencies (Res. Cr.)
 - Taxes (Res. Cr.)
- Net Operating Revenues**
- Per cent Net Operating Revenues to Operating Revenues
 - Per cent Net Operating Revenues to Total Investment
- III. Electric Statistics**
1. Load Statistics
 - Input kw-hr. (Metered)
 - Output kw-hr. (Metered)

III. Electric Statistics, *Continued*

Output in per cent of input
 Total kw-hr. loss
 Line Loss—kw-hr.
 Transformer Loss kw-hr.
 Unaccounted for kw-hr.
 Total loss in per cent of input
 Line loss in per cent of input
 Transformer loss in per cent of input
 Unaccounted for in per cent of input
 Max. 15 in. demand (kw.)
 Total connected load
 Demand Factor per cent
 Average Hourly Input
 Load Factor per cent
 Reactance kv-a. input (metered)
 Aver. Power Factor

2. Customer Statistics

Total Investment per consumer
 Primary Lines
 Secondary Lines
 Services
 Transformers
 Meters
 kw-hr. input per Consumer
 kw-hr. loss per Consumer
 kw-hr. sold per Consumer
 Miles of line per Consumer
 Aver. connected load per Consumer
 Stepdown Transformer Capacity per Consumer
 Gross Oper. Revenue per Consumer
 Gross Oper. Expense per Consumer
 Net Oper. Revenue per Consumer

It is not thought that these setups will fit the conditions of every company engaged in the study of rural lines, but they are made to fit the specific conditions under which one company is operating. The accounting systems of different companies will undoubtedly differ from the one shown above and in making a study of the rural lines and collecting information for the Committee, it is not necessary for any company to change in any way its system of accounts as now being used. It will undoubtedly be necessary to continue this study over a number of years before the cost of operating and maintaining rural lines can be definitely determined. The Committee feels it is very necessary, however, that this work be started at once and continued until it is deemed sufficient and reliable information has been assembled.

Financing and Rates

It is quite generally conceded that the organization of a large number of small public utilities owned and operated by farmers is not desirable. It is generally conceded that the public utility operating in urban territory should have control of the operating and maintaining of all rural lines supplied by such utility. Due to the large amount of distribution system per rural customer and to the increased costs of operation, including greatly increased cost for taxes and depreciation, it can readily be seen that city rates designed for city conditions will not generally provide sufficient revenue to compensate the utility for rural service. Even though the farmers may pay the entire construction cost of the rural distribution system, city rates

usually provide a wholly inadequate revenue. It is therefore very necessary to make a careful analysis of all costs entering into rural service in order to arrive at a proper rate. These costs are similar to those in city distribution, except they do not bear the same proportion to each other. These items of cost are generally known and are discussed at some length in the various reports shown in the Appendix. Particular attention is called to the large distribution losses, the low load factor and the low power factor. Maintenance of lines, meters and transformers, removal and resetting of transformers and meters, inspection of transformers, inspection and testing of meters, reading of meters and trouble service, all involve far greater expense on rural lines than on city distribution lines.

The rural rate must cover all of these costs, all general and overhead costs, and in addition provide sufficient revenue to cover taxes, depreciation and other fixed charges on a much larger investment per customer than is customary in city distribution systems. A large per cent of the rural customers now being served are receiving electric service at less than cost. This has established a bad precedent which will be difficult to overcome. The Committee hopes that each utility will make a careful study of its plan of serving rural customers and will not connect any additional customers on a less than cost basis. A number of different plans for supplying rural service where rural customers are served as individuals are now in effect in various sections of the country. The Committee has studied these various plans and submits a brief analysis of the different methods used in Table I.

In every case there are a number of reasons why a particular plan is being followed. The Committee has thought it advisable to present a discussion showing the advantages and disadvantages of the fundamentals covered by these various plans. The Committee does not feel that it is in a position to make definite recommendations at this time and wishes it understood that no preferences or recommendations are intended in the following analyzed remarks:

The following discussion is from the utility standpoint:

Advantages of Customer contributing cost of line.

Lower monthly bills to customer which encourages use of current.
 Permanent customer assured.
 Utility's risk of losing investment is reduced.

Is about the only way utilities are able to build rural lines in the average rural territory at least at this time, owing to financing difficulties that are common to all industrial projects. Financing of fundamental plant and line extensions must take precedence over the newer projects for the present.

The farmer is usually willing to contribute his portion of the cost of the extension as it is usually less than the cost of an individual farm lighting plant.

PLAN NO. 1

TABLE I

BRIEF ANALYSIS OF DIFFERENT METHODS USED IN RURAL LINE DEVELOPMENT WHERE RURAL CUSTOMERS ARE
SERVED AS INDIVIDUALS

Plan No.	Financing	Ownership	Maintenance	R A T E S			
				Service Charge	Plus	Energy Charge	
1	<i>By the Customer</i> Customers provide the money for entire construction of lines	<i>By the Utility</i> Customers give title to utility without cost	<i>By the Utility</i>	Sufficient to cover amount by which maintenance, depreciation, taxes, operating costs and losses exceed the corresponding items in City Service allowance made for customer's investment		Regular Charge	This plan has the approval of the Wisconsin State Utilities Commission. Also recommended by Rural Lines Committees of Wisconsin, Nebraska Electrical Associations and Ohio Electric Light Association
2	Same as 1	<i>By the Customer</i> Utility to have option on its purchase	<i>By the Utility</i> Customers to be billed monthly for actual maintenance; also for liability insurance	Sufficient to cover operating costs and fixed charges on investment, resting with utility, giving consideration to customer's demand and transformer losses		Special primary rate with low excess rate	Plan used by some companies in Iowa and Illinois
3	<i>By the Utility</i> Either by sale to customers of its securities or from other sources	<i>By the Utility</i>	<i>By the Utility</i>	Same as 1, except an additional amount to provide a return on investment or the regular city rates throughout under a contract guaranteeing a minimum revenue per year sufficient to equal total investment in lines from 3 to 4 years		Regular City Rates	This plan is used only in comparatively densely populated territory
4	<i>Jointly</i> <i>Utility-Customer</i> Utility advancing an amount from 2 to 3 times amount of annual revenue; the customers to provide the balance	<i>By the Utility</i>	<i>By the Utility</i>	Same as 3		.....	Same as 3
5	<i>By the Utility</i>	<i>By the Utility</i>	<i>By the Utility</i>	A calculated amount paid in one lump sum sufficient to make good the deficit which would otherwise be incurred by the utility by reason of the construction and operation of the extension during the development period		Regular City Rates	Plan developed by Committee of the Northwest Geographic Division

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Disadvantages of Customer contributing entire cost of line.	Is not entirely in accordance with the method generally used to finance lines in cities. Customers must bear all costs in any event. Customer financing tends to hide this fact and may bring a rude awakening eventually, when customers wake up to the fact that investment costs must be added to the current bills to obtain the true costs.	Advantages of City Rates plus rural service charge.	Employs a rate structure which in force usually bears the approval of the utility commission and has been developed over a considerable period. Is readily explained to customers. Eliminates any question of discrimination between rural and city customer. This plan is very flexible and the rural service charge can vary to meet changing conditions.
<i>PLANS NOS. 1 & 2.</i>		<i>PLANS NOS. 1 & 3.</i>	
Advantage of Customer Ownership.	Customers must pay the maintenance and operating costs whatever they may be and utility is not required to estimate these costs. The rates of lines owned by customers are usually lower than the rates where lines are owned by the utility. This may encourage the use of electric current.	Disadvantages of City Rates plus rural service charge.	May not be equitable, especially where no Public Utility Commission has jurisdiction; however, due to the rural charge part of the rate, the rate would be much more correct to the rural customers than it would be to city customer.
<i>PLAN NO. 2</i>		<i>PLANS NOS. 1 & 3.</i>	
Disadvantage of Customer Ownership.	Complicates matters in every operation as owners must always be consulted. In the development of the territory supplied by a utility it may become desirable to change a strictly rural line into a transmission line. If the farmer owns the rural line the utility may experience considerable difficulty in having the change made. Ownership of lines in the rural district may lead to ownership of lines in cities. In some states ownership gives franchise to owner. It is contrary to the practice established by utilities in cities. If the customer owns the lines there is no real assurance of proper maintenance and upkeep of lines. The condition of many rural telephone lines is a striking example of what may happen, if customers are required to own the lines and pay the cost of maintaining and repairing these lines.	Advantage of Special Rate	It is thought a rate can be so designed that only one meter per customer is required. This rate permits deviation from any existing unfair city rates and may be so arranged as to encourage use of service to the utmost.
<i>PLAN NO. 2</i>		<i>PLAN NO. 2.</i>	
		Disadvantages of Special Rate.	It is more complicated in arriving at in that the rate is built up from data including power house equipment, transmission lines, etc. Is therefore more difficult to explain to customers. There is danger of the question of discrimination being raised by either the rural or city customer. Many small utility companies are not able to develop a fair and equitable rural rate.
		<i>PLAN NO. 2.</i>	
Advantages of Utility Ownership.	Is in accordance with the general practice established in cities. Gives utility complete control over lines. If the utility owns the rural lines it can rebuild and change them into either higher voltage distribution lines or even transmission lines. Eliminates any question of responsibility which may lead to damaging disputes.		
<i>PLANS NOS. 1 3, 4, & 5.</i>			
Disadvantages of Utility Ownership.	Utility must estimate the cost of operating and maintaining rural lines, and carry the burden of such errors as are natural in a new business venture. Without the proper guarantees and contracts there is a possibility of all customers discontinuing service from the line.		
<i>PLANS NOS. 1 3, 4 & 5.</i>			

Value of Service to the Farmer

Unless rural service is worth more than it costs it should not be supplied. The sum total of the very meager data available indicates that electric service on the farm is worth much more than it costs. Neither the utility nor the farmer knows very much regarding the varied uses to which farmers can put electricity, nor does either fully appreciate its actual value. The farmer is inclined to estimate this value in dollars and cents much more highly than is the utility manager, even in this period of farm value depressions. The longer a farmer has had available to him electric power on a farm, the higher value he places upon it. The attitude of the management of the company rendering the service is reflected in direct ratio with the value the farmer places on the service. In every instance where a careful study of the value of current to any specific application has been made the dollars and cents value is much greater than any one generally supposed it to be. The Committee is collecting additional information on this phase of the business and hopes to present definite figures next year.

Development of Farm Equipment Suitable for Electric Drive

The successful development of rural electric service depends to some extent upon the amount of electrical energy that can be economically used by the farmer. No problems are presented on the farm essentially different from those that exist in the city home. The farm itself presents much the same problem that the factory presented to the central station commercial engineer and the equipment manufacturer fifteen or twenty years ago. Then the factory equipment was designed to fit the facilities of the older forms of power-providing equipment. Since then the whole electrical industry has applied itself to producing equipment that would fit the facilities of the newer source of power sup-

ply, so that now the older forms of equipment look extremely crude. The same process of development must be employed with farm equipment, though fortunately the solution of the factory problems has taught a lesson that will shorten the process and eliminate many of the mistakes that would otherwise be inevitable. But the central station company must interest itself and play an important part in the solution of the problem of developing farm equipment, because it is one of the most essential points of contact between the farmer and the manufacturer. The Committee is making a study of the needs of the farmer and of the electrically driven equipment now available and hopes to assist in accelerating the development of additional machines suitable for farm service.

Respectfully submitted,

RURAL LINES COMMITTEE

G C NEFF, *Chairman*

A J ALTHOUSE
P P ASHWORTH
F H BROOKS
JOHN W CARPENTER
P T DAVIES
J M DRABELLE
THOMAS F ENGLISH
R E FISHER
D L GASKILL
FRED D GORDON

H H HENLEY
J E HILLEMAYER
EUGENE HOLCOMB
W H HORTON, JR.
R H HOWARD
S A HUNTER
ARTHUR HUNTINGTON
O A JENNINGS
E G JONES
W G KELLEY

R J LONG
LEWIS A McARTHUR
J C MARTIN
C K NICHOLS
PHIL H PALMER
H M PARSONS
C A SEMRAD
D W SNYDER
J A WHITLAW
H G WILLS

APPENDIX 1.

Report of Committee on Rural Extensions—Wisconsin Electrical Association, March 23, 1921

General

Discussion of Statistics

The report made to the 1920 convention of this association by the Committee on Rural Extensions discussed the theory of charges to be made in connection with rural extensions, and proposed a set of rules to govern the construction of lines and the charges for service. There was considerable discussion at the convention and a committee was again appointed to continue the study of the subject.

Since that time these proposed rules, with slight modifications, have been used by at least 15 utilities in various parts of the state as the basis for extensions to a large number of rural customers. The committee has investigated some of these extensions together with several made on other bases and has gathered statistics which are represented in this report. The various features of the rules proposed in 1920 have been studied in the light of last year's experience with the result that certain modifications are herein proposed. The underlying theory expressed fully in the previous report appears correct and the modifications now proposed are intended only to make the rules simpler and easier of application.

Statistics

The statistics gathered by the committee as given in the following tables should be of considerable value in fixing a basis for future calculations. They cover extensions to over two hundred farmers and seem to fairly represent present conditions in Wisconsin.

Table II shows that the eight extensions investigated were in general constructed of 30 foot 6-inch top cedar poles spaced 150 feet with No. 6 hard drawn bare copper wire. These lines are single phase and three phase and are operated at 2200 and 6600 volts. 2200 volt distribution should prove satisfactory for short rural lines. 4000, 4400, 6600 volt distribution will be needed for the more extensive rural developments. The general tendency in electrical distribution and transmission is toward higher voltages and this is also common to rural distribution. Utilities constructing 2200 volt rural lines will do well to anticipate future requirements. Future demands for increased capacity may be met by changing to 4000 volt, 3 phase, 4 wire or to 4400 volts either single phase or three phase. By the use of transformers having 2200-4400 volt primary windings provision can be made at little expense for materially increasing the capacity of the line.

Table IV shows an average of 2.6 customers per mile with an average installation of 2.24 kw. and consuming 32 kw-hr. per month with an average bill of \$6.53 per month. About one-half of this is rural charge and one-half the charge of city rates. The average combined cost of general and local equipment is \$476 per customer.

Table VI appeared in the 1920 report and has been found of such value as to warrant its being included in the present report.

TABLE II

PHYSICAL CHARACTERISTICS AND CONSTRUCTION COST OF RURAL EXTENSIONS

Extension Number	Date of Construction	Length in Miles	**Poles Predominating Size	Poles Average Number per Mile	*Primary Wire Size and Material	Voltage	Phase	Step Down Transformers Number Connected	Step Down Transformers, K. V. A. Connected	Construction Cost of Transformers Serving Extension (General Equipment)	Cost of Primary Line (General Equipment)	Cost of Step Down Transformers, Transformer Protection & Secondary Lines (Local Equipment)	Total Construction Cost (Local & General Equipment)	Number of Customers Connected
1	1920	4.50	30'-6"	35	No. 6 Copper	2200	1	12	35	450	3627	1375	5452	16
2	1917	23.00	20'-6"	40	3-No. 9 Iron	6600	1&3	60	121	.....	15755	6890	22645	58
3	1917	14.00	25'-6"	32	3-No. 10 Iron	6600	1&3	45	61	.....	10500	3550	14050	30
4	1920	5.20	30'-6"	36	No. 6 Copper	2200	1	12	34	401	5631	1199	7232	16
5	1920	7.25	30'-7"	35	No. 6 Copper	6600	1	19	28	968	7306	4800	13074	17
6	1920	2.25	30'-6"	35	No. 6 Copper	2200	1	6	12	.....	2160	1296	3456	6
7	1920	6.37	30'-6"	35	No. 6 Copper	2200	1	18	36	.....	6885	3890	10775	18
Total		62.57						172	327	1819	51864	23000	76684	161
***8	1919	28.00	30'-6"	35	No. 6 Copper	6600	1 & 3	76	239					85

* All copper conductor is No. 6 solid hard drawn bare copper. Iron Conductors consist of three wires twisted together.

** Poles in extension No. 1, 2, 3, 7 and 8 are Northern Cedar untreated.

Poles in extensions No. 4, 5 and 6 are Western Cedar "A" butt treated.

*** Construction Cost of No. 8 is not available.

REPORT OF THE RURAL LINES COMMITTEE

TABLE III
CONSTRUCTION COST, KW-HR. SOLD, REVENUES AND CONNECTED LOAD

Extension Number	Number of Customers	Construction Cost All Equipment	Number of K. W. H. Sold per Year	Monthly Revenue from Rural Charges	Annual Revenue from City Rates	Total Annual Revenue	K. W. Connected Load Lighting and Irons	K. W. Connected Load (HP x ¾)	K. W. Connected Load Range	Total Connected Load, K. W.	Number of years in which the revenue from city rates will equal construction Cost
1	16	5460	8460	390.00	709.00	1099.00	23.1	7.5	6.0	36.6	7.7
2	58	22645	23535	1951.00	2110.00	4061.00	61.0	85.0	0	146.0	10.7
3	30	14050	9547	1286.00	901.00	2187.00	33.0	31.0	0	64.0	15.6
4	16	7232	9300	557.00	780.00	1337.00	15.3	18.7	0	34.0	9.3
5	17	13074	4239	1249.00	466.00	1715.00	27.7	3.0	0	30.7	28.1
6	6	3456	2940	247.00	434.00	681.00	7.3	4.0	0	11.3	8.0
7	18	10775	3844	974.00	576.00	1550.00	25.7	10.0	0	35.7	18.7
Total	161	76684	61865	6654.00	5976.00	12630.00	193.1	159.2	6.0	358.3	12.8
*8	85		38652								

* Missing data for extension No. 8 is not available.

NOTE: In several of the extensions the revenue shown is calculated.

Proposed Rules and Rates and Discussion of Same

The following definitions and rules are recommended by the Committee. Following each rule, in smaller type, are the explanations, comments and reasons for changes from the wording in the 1920 report. Minor changes have been made without comment.

Rules and Rates for Rural Extensions

1. Rural Customer and Rural Extension Defined

The term rural customer as herein used refers to

the farmer or other consumer of electrical energy who is not located within the corporate limits of any city or village, or in other territory having similar character or density of population.

The term rural extension relates to an extension made primarily to serve rural customers.

The Railroad Commission of Wisconsin has held informally that city rates and rules must be applied to all business located within the corporate limits of cities and villages.

2. Analysis of Extension

When one or more prospective rural customers

TABLE IV
AVERAGE VALUES OF DATA IN TABLES II AND III

Per Mile				Per Customer												
Extension Number	Customers per Mile	Construction Cost of Transformers Serving Extension (General Equipment)	Cost of Primary Line (General Equip-ment)	Construction Cost of Transformers Serving Extension (General Equipment)	Construction Cost Primary Line (General Equipment)	Construction Cost Step Down Trans-formers, Transformer Protection & Second-ary Lines (Local Equipment)	Total Construction Cost (General and Local Equipment)	Step Down Trans-former, K. V. A.	K. W. Connected Lighting Load In-cluding Irons	K. W. Connected Power Load	K. W. Connected Range Load	Total Connected Load, K. W.	K. W. H. Sold per Month	Monthly Revenue From Rural Charge	Monthly Revenue From City Rates	Total Monthly Revenue
1	3.5	\$100.00	\$808.00	\$28.00	\$226.00	\$85.90	\$339.90	2.2	1.44	.48	.38	2.30	36.6	2.03	3.70	5.73
2	2.5	.....	685.00	.....	271.00	119.00	390.00	2.1	1.05	1.46	.00	2.51	28.2	2.81	3.00	5.85
3	2.1	.....	742.00	.....	346.66	118.33	364.99	2.0	1.10	1.03	.00	2.13	22.0	3.58	2.51	6.09
4	3.0	77.00	1082.00	25.00	351.00	75.00	457.10	2.2	.96	1.16	.00	2.12	40.3	2.90	4.06	6.96
5	2.6	133.44	1005.00	51.00	401.00	282.00	704.60	1.5	1.63	.18	.00	1.81	18.3	6.12	2.40	8.52
6	2.7	.....	961.00	.....	360.00	216.10	575.00	2.0	1.21	.66	.00	1.87	34.0	3.43	6.04	9.47
7	2.8	.....	1080.00	.....	383.00	216.00	599.00	2.0	1.42	.56	.00	1.98	15.6	4.50	2.67	7.17
Weighted Average																
2.6			829.00	**	322.00	142.00	476.00	2.0	1.20	1.00	.04	2.24	32.0	3.44	3.09	6.53
*8 3.0								2.8					31.6			

* Missing Data for Number 8 not available.

** Weighted average for all extensions is 11.30.

REPORT OF THE RURAL LINES COMMITTEE

TABLE V

TABLE SHOWING THAT TRANSFORMER CORE LOSS IS A FAIR MEASURE OF EXCESS DISTRIBUTION LOSS IN RURAL EXTENSIONS AS ASSUMED IN 1920 REPORT*

Extension Number	K. W. H. furnished to extension in 1920	K. W. H. Sold from extension in 1920.	K. W. H. Loss	Percentage of Loss	Number of K. W. H. input for each K. W. H. sold	Transformer core loss computed from Manufacturer's data on Transformers	Total Measured loss less core loss computed on basis of Table IV	Percentage of loss in addition to computed core loss (comparable to city distribution)
2	57,080	23,535	33,545	58	2.42	18,890	14,655	25%
3	28,084	9,547	18,537	66	2.94	9,438	9,099	32%
8	78,650	38,652	39,998	51	2.04	24,820	15,178	19%
	163,814	71,734	92,080	56	2.28	53,148	38,932	24%

* In the 1920 report it was assumed that "the excess loss in rural distribution is equal to the total core losses of all transformers used in supplying the rural service." The usual distribution loss in city distribution is about 20%. The above data covering these rural lines indicates that the assumption made in the 1920 report is conservative.

make written request for electric service the utility will investigate the extension, ascertain the number of customers who can be advantageously served, the number willing to contract for service under the terms herein prescribed, and will estimate the construction cost.

3. Construction Cost

Construction cost shall include the following:

(a) Cost of General Equipment includes all costs of labor and material directly chargeable to the rural extension from the point where the rural extension originates to the local equipment at the customers' premises. Where transformers are necessary to supply energy to the extension they are included together with all auxiliary and protective devices. Items of freight, cartage, purchasing and store room expense are included.

To the above will be added an item not exceeding 15 per cent of these costs to cover engineering, promotion, office supervision, clerical labor, and contingencies.

(b) Cost of Local Equipment includes all costs

of labor and material required for the installation of step-down transformers supplying the customers, together with all secondary mains, service drops, service brackets, protective devices and appurtenances. Items of freight, cartage, purchasing and store room expense are included.

To the above will be added an item not exceeding 15 per cent of these costs to cover engineering, promotion, office supervision, clerical labor, and contingencies.

Metering equipment will be supplied by the utility at its own expense.

It seems desirable to separate the local equipment cost from the general equipment cost in order that each individual may pay for the local equipment necessary to take care of his requirements. This method of apportionment although not specified may be used under the 1920 rules.

4. Payment Customers

When the prospective rural customers pay to the utility the estimated cost of general equipment, the utility will proceed to purchase and install the same. When the above payment has been made and a prospective rural customer further pays to the utility the estimated cost of local equipment required to serve him, the utility will proceed to purchase and install the local equipment.

When local equipment serves more than one customer the utility will apportion the cost between the various users and each customer shall pay his portion so determined.

If the actual construction cost exceeds the estimated construction cost, the prospective customer shall, upon demand, pay a part of the difference in proportion to the amount originally advanced. If the actual construction cost is less than the estimated construction cost the utility will refund the difference to the customer in proportion to the amount advanced.

Utilities should exercise care in estimating the construction cost in order that it will not be necessary to make additional collections from customers after construction is completed. Considerable difficulty may be expected where the estimates are made too low.

TABLE VI

APPROXIMATE CORE LOSS OF TRANSFORMERS

Size K. V. A.	2300—{115 V. 230 V. Loss in Watts	6900—{115 V. 230 V. Loss in Watts	13800—{115 V. 230 V. Loss in Watts
1.0	19	..	..
1.5	..	27	..
2.0	24	..	..
2.5	..	..	46
3.0	32	36	..
5.0	40	50	68
7.5	54	69	..
10.0	64	87	106
15.0	88	114	160
25.0	120	171	240
37.5	175	230	320

5. Connection Charge for Additional Customer

An additional rural customer will be connected to an extension upon the payment of a connection charge plus the cost of the local equipment necessary to serve him.

This connection charge will be determined by dividing the total cost of general equipment of the original extension by the number of original customers.

If the cost of general equipment required to serve the additional customer is less than the connection charge the additional customer shall pay the connection charge and the cost of local equipment, whereupon the utility will make the connection. The difference between the connection charge and the cost of general equipment shall be refunded to the customers on the extension (including the additional customer) in proportion to the amounts advanced.

If the cost of the general equipment required to serve the additional customer is greater than the connection charge, the additional customer shall pay the cost of the additional general equipment required and the cost of local equipment, whereupon the utility will make the connection. In this case no refunds will be made to the original customers.

Subject to the approval of the Railroad Commission of Wisconsin the utility may, in not less than five years after the beginning of the extension, consider the development period completed and may thereafter connect additional customers upon the payment of the actual cost of the general and local equipment necessary to serve them.

The changes in this rule were made necessary in part by the division of construction cost into general and local equipment costs. The last paragraph of this rule is an addition to the previous rules and seems advisable to the committee.

6. Rates

The rates for rural service shall be:

- A. A Rural Charge, plus
- B. The Regular City Rates.

A. *Rural Charge.* The rural charge shall cover the amount by which the fixed charges, energy losses and operating expenses incident to rural service exceed the corresponding items for equivalent revenue from city service.

(a) Annual Rural Charge for Extension. The annual rural charge for the extension shall be equal to:

10 per cent of the total construction cost of the extension, plus the total transformer core losses per year computed at the utility's cost of energy, minus

27 per cent of the annual revenue from the extension resulting from the application of the regular city rates.

(b) Annual Rural Charge for Individual Customers. The annual rural charge of the individual customers will then be determined as follows:

50 per cent of the total annual rural charge shall be apportioned equally among the customers.

50 per cent of the total annual rural charge shall be apportioned among the customers according to

installed transformer capacity. In case two or more customers are served from the same transformer the installed transformer capacity for each customer shall be considered as the estimated portion installed for the requirements of each individual.

(c) *Monthly Rural Charge.* One-twelfth of the annual rural charge so apportioned to each customer shall be billed monthly by the utility and paid by the customer as the monthly rural charge.

For a rural extension the items of depreciation, taxes, excess operating expense and hazard have been found to equal about 10% of the construction cost as follows:

Depreciation	4%
Taxes	1½%
Excess maintenance and operating expense, and hazard	4½%

Total 10% of Construction Cost

The city rates are designed to cover taxes, depreciation and a return on the investment in the city distribution system as follows:

Taxes	1½%
Depreciation	4%
Return	8%

Total 13½% of investment

The average investment in city distribution systems is equal to about *twice* the annual revenue. These fixed charges carried by city rates can therefore be expressed as 27% of the annual revenue.

The rural charge should not include any expenses covered by the regular city rates. The 10% of construction includes all fixed charges on the rural extension. It is therefore necessary in computing the rural charge to deduct the amount of fixed charges covered by the regular city rates.

The data in Table V confirms the 1920 assumption that the computed transformer core loss is a fair measure of the *excess distribution loss in a rural extension.*

B. *Regular City Rate.* In addition to the rural charge, the customer shall pay the regular rates charged for service in the city where the extension originates. This charge will include all minimum and demand charges which are a part of the city rates.

7. Annual Adjustment in Rural Charge

Adjustments will be made in the rural charge at the end of each calendar year to allow for changes in the number of customers, the revenue from the line, or changes in transformer capacity, and the rural charge then fixed shall be effective for the following calendar year.

In case a uniform rural charge is used as discussed later it may be desirable to omit Rule 7.

8. Combined Transmission Line and Rural Extension

In case the rural extension is constructed for use partly as a transmission line to some larger customer, city, village or hamlet, and the business to be derived from the use of the extension as a transmission line, is inadequate to justify the construction of the extension without a portion of the cost being paid by rural customers, such portions of the cost of general equipment as may be equitably apportioned to the rural business shall be paid for by the prospective rural customers. Rural customers shall in all cases pay for local equipment.

9. Change in Equipment

When the capacity, size or character of any general or local equipment needs to be increased or changed in order to adequately take care of the rural service, the customer or prospective customer, whose requirements necessitate the change, shall pay for the same. Apportioning of such payments shall be the same as for new extensions.

10. Title to Extension

The title to extensions toward which customers have advanced money shall be vested in the utility.

11. Limitation of Service

Individual customers' appliances may be limited to a demand of 5 kilowatts (5,000 watts or 6-2/3 h.p.) if the characteristics of the line do not permit giving reasonably good service with larger appliances. The characteristics of all equipment connected to the line is subject to the approval of the utility.

12. Construction

Construction shall conform to good practice and shall be equal to or better than the minimum standards required by the Railroad Commission of Wisconsin. The utility is to be the judge as to the design, capacity, and construction of general and local equipment.

13. Extension from High Voltage Transmission Line

Rural extensions from transmission lines of over 15,000 volts will be considered special by the utility because of the operating and construction features involved.

14. Continuity of Service

The customer understands and agrees that service will be furnished from a single line and that service may be interrupted from time to time due to accident or the making of repairs. The utility will use reasonable diligence in furnishing an uninterrupted and regular supply of electrical energy.

15. Access to Customers' Premises

The utility shall have the right at all times to make an examination of apparatus and materials placed by it on the premises of the customer and to make such changes and improvements as shall, in its opinion, be necessary for the proper operation of the installation at such times as may be mutually agreed upon.

16. Inspection of Installation

The utility shall have the right at all times to make an examination of installation of lights, motors, and other apparatus of the customer and it may refuse to make connection or give service unless the installation is in proper condition to receive and to utilize the same. The customer shall not make any changes in his installation which may harmfully effect the operation of the utility's apparatus without consent of the utility.

17. Default

If the customer defaults in payment of bills or fails to comply with the utility's rules after specific notice has been given, the utility may disconnect service and remove its metering equipment.

18. City Rules

Rules applying to the utility's city service except as herein modified, shall also apply in general to rural service.

19. Modification of These Rules and Rates

It is understood that the foregoing rules and rates may be modified from time to time subject to the approval of the Railroad Commission of Wisconsin.

Uniform Rural Charge and Special Electric Rate

In the 1920 report it was suggested that a rural charge be determined for each extension and that this charge be adjusted annually. Realizing that simplicity is greatly to be desired, considerable attention has been given to the possibility of applying a uniform schedule of rural charges, in a specified territory, or to the entire rural business of a utility.

This rural charge would vary with the amount of transformer capacity installed and would not be subject to annual adjustment but would be under the usual commission regulation.

This plan has the advantage of simplicity and eliminates the necessity for a special investigation to determine the rural charge for each extension.

The plan has the disadvantage that certain customers will pay a higher and others a lower rural charge than the rural charge computed on the original basis. The application of a uniform rural charge to work out successfully must be preceded by a careful survey of the territory involved, and it is recommended that this plan be used only by utilities willing to make such an analysis. For such cases, substitute the following rule for part A of Rule 6 (Rural Charge).

Substitute Rule for Rule 6 A

Rates. The rates for rural service shall be a rural charge plus the regular city rates, or their equivalent. The rural charge shall represent the average amount by which the fixed charges, energy losses, and operating expenses incident to rural service exceed the corresponding items for city service and shall be "X" dollars per month per customers plus "Y" dollars per month per kv-a. of installed transformer capacity.

If 50 per cent of the total rural charge is apportioned equally among the customers and the remaining 50 per cent apportioned among the customers according to installed transfer capacity, as defined in the 1920 report and in the foregoing, then "X" is equal to 50 per cent of the average monthly rural charge determined for the territory and "Y" is equal to 25 per cent of the average monthly rural charge determined for the territory, assuming a 2 kw. transformer to be an average installation per customer. The average monthly rural charge for the system made up of extensions 1 to 7 inclusive, is \$3.44 and the average transformer capacity per customer is 2 kv-a. Therefore the rural charges for this system would be as follows:

1	kv-a. transformer installation.....	\$2.58 per month
2	kv-a. transformer installation.....	3.44 per month
3	kv-a. transformer installation.....	4.30 per month
4	kv-a. transformer installation.....	5.16 per month
5	kv-a. transformer installation.....	6.02 per month

REPORT OF THE RURAL LINES COMMITTEE

TABLE VII

The Reason for Rural Charge

The excess cost of several rural business (the Rural Charge) is illustrated approximately in the following: The values for city conditions and rural conditions are shown in separate columns.

	City Conditions	Rural Conditions
1. Average amount sold per year per rural customer (derived from Table III).....	384 kw-hr.	384 kw-hr.
2. Cost to customer of 384 kw-hr. at city rates (derived from Table III).....	\$37.12	\$ 37.12
3. Average investment in distribution system necessary to deliver 384 kw-hr. per year.....	74.24 (a)	476.00 (b)
4. Loss in delivering 384 kw-hr. to customer per year....	96 kw-hr. (c)	492 kw-hr. (d)

Annual Costs

	City Conditions	Rural Conditions
1. Return at 8% per annum.....	\$ 5.94	\$ 0.00
2. Depreciation at 4% per annum....	2.97	19.04
3. Taxes at 1½% per annum.....	1.11	7.14
4. Distribution Loss at 1½c per kw-hr. (Based on unusually low cost of power production).....	1.44	7.38
5. Excess Maintenance Hazard and excess operating expenses 4½% of investment.....		21.42
6. Total	\$11.46	\$54.98
7. Excess cost of serving rural business per year.....		43.52
8. Excess cost of serving rural business per month.....		3.62

(a) An analysis made of certain Wisconsin cities indicates that investment in distribution system for small customers is about twice the annual revenue.

(b) This is an actual weighed average figure obtained from data in Table IV.

(c) Based on an efficiency of 80% in distribution which is a fair average for city conditions.

(d) These are measured losses and are higher than the calculated losses and this accounts for rural charge in this table being slightly greater than the rural charge in Tables IV and VIII.

TABLE VIII

Following are the total figures for extensions 1 to 7 inclusive:

Cost of line.....	\$76,684
Number of Customers.....	161
Length of line—miles.....	62.5
Revenue at City Rates.....	\$5,976
Assume 161—2 kilowatt transformers in entire system core loss per annum*.....	42,343kw-hr.
Calculations of Rural Charge according to rule 6 employing above totals:	
10% of construction cost(\$76,684).....	\$7,668.40
42,343 kw-hr. @ 1½c per kw. =.....	635.14
Total	8,303.54
Less 27% of Annual Revenue at City Rates (\$5,976)	1,613.52
Annual rural charge for extension.....	6,690.02
Monthly rural charge for extension.....	557.50
Average monthly rural charge per customer (161 customers).....	3.44

*Calculated from Table VI.

The 1920 report specified that in addition to the rural charge the customer should pay for service at the regular city rates. This has the advantage of employing a rate structure which is in force, bears the approval of the Railroad Commission, has been developed over a considerable period and changes automatically with city rate adjustments. This may be of some satisfaction to the rural customer. It has the disadvantage, however, of requiring some customers to have more than one meter as city rates do not ordinarily provide a schedule for combined lighting, power and heating service.

Other forms of rates have been suggested to admit of the use of a single meter any of which may be designed particularly for rural business. Such a rate might be an increment (block meter) rate substantially as follows:

Substitute for Rule 6 B

"In addition to the rural charge the customers shall pay the following:

First 20 kw-hr. per month @.....per kw-hr.
Next 80 kw-hr. per month @.....per kw-hr.
Excess kw-hr. per month @.....per kw-hr.

"Subject to a minimum monthly charge ofper month per horse power connected motor load, plus
.....per month per kw. of connected lighting load, plus
.....per month per kw. of connected range load."

In this rate, the first step of 20 kilowatt hours is intended to cover the average monthly use of energy for lighting, whereas, the remainder of the schedule is intended to cover the use of energy for power and cooking.

A rate of this kind for combined light, power and heating would have the advantage of economy in meter investment, testing, reading and billing. It would be advisable only when the utility is willing to make the necessary study in order to properly determine a rate of this kind.

Calculation of the Rural Charge

In order to explain the derivation of the rural charge two calculations have been made in Tables VII and VIII.

Proposed Form of Contract with Discussion of Same

Experience has shown that it is of vital importance that the entire proposition should be definitely understood between the parties and must be included in a formal contract. The Committee recommends the following form which must have the rules and rates printed on the back thereof.

PROPOSED RURAL EXTENSION CONTRACT

Contract for Electric Light, Heat and Power for Service along the.....rural extension.

Agreement made this....day of.....,19.... by and between....., party of the first part, hereinafter referred to as the "Company," and....., party of the second part, hereinafter referred to as the "Customer."

The parties hereto, each in consideration of the agreements of the other, agree as follow:

First. The Company shall extend and supply electric service for the Customer's use in operating light, miscellaneous motors and other appliances installed, or to

REPORT OF THE RURAL LINES COMMITTEE

to be installed, by the Customer on his property known aslocated at, the installation now estimated to be approximately as follows:and requiring for such use an amount of electric power and transformer and line capacity now estimated at.....apparent watts subject to the terms and conditions stated herein and in the rules and regulations on the back hereof:

Second. The Customer agrees to pay to the Company his proportion of the construction cost of general equipment as defined on the back hereof, this amount being estimated at.....dollars (\$....). The proportion of actual cost may be greater or less as defined in the rules on the back hereof. The estimated amount is to be paid before materials are purchased and construction started and this amount is to be adjusted immediately when the line is completed to equal the customer's proportion of the actual cost.

Third. The Company agrees to provide and install the following local equipment:

.....
.....
for which the customer agrees to pay the actual construction cost of same as defined on the back hereof now estimated at \$..... This estimated amount is to be paid by the customer before materials are purchased or installed and is to be adjusted to the actual amount of construction cost when this is known, either by a refund to customer or by an additional payment by customer.

Fourth. The Customer agrees to pay additional for changes in size, capacity, or character of General Equipment or Local Equipment which may become necessary from time to time in order to take care of his service.

Fifth. The Customer further agrees to pay a Rural Charge as defined on the back hereof amounting initially to \$..... per month and in addition agrees to pay the authorized rates of the Company, both as defined on the back hereof or as later modified with the approval of the Railroad Commission of Wisconsin.

Sixth. The Customer shall take said electric energy only as above stated, and shall not sell or otherwise dispose of any said electric energy.

Seventh. This agreement shall continue in force until

Eighth. It is understood by both parties that this contract is subject to the approval of the Company and shall not be binding on the Company until endorsed by a duly authorized officer of the Company.

Ninth. This agreement, including the terms and conditions on the back hereof shall be binding on the parties hereto, their heirs, executors, administrators, successors, and assigns.

Witnessed:

Customer

Company

It should be understood that the Railroad Commission of Wisconsin requires each utility to file its rules and rates covering rural extensions. The Committee feels that the proposed rules and rates and contract presented in this report are in general suitable for adoption and for filing with the Commission.

Conclusion

Although a large number of rural extensions have been made in the last two or three years we feel that this development has only begun. In the interest of both the customer and the utility the business should be developed on a sound basis both financially and physically. The Committee's effort in the 1920 report and in this report has been toward developing a sound financial basis for these extensions.

Respectfully submitted by
RURAL LINE EXTENSION COMMITTEE

APPENDIX 2

Amended General Order No. 59 of the State Commission of Illinois

Class I—Those Consumers Who Have Formed a Corporation for Rendering Service

1. Certificate of Convenience and Necessity.

Those consumers who have formed a corporation as given under class one, and who expect to render service to all applicants along the routes of the lines built by them, are public utilities and as such shall secure from the Commission, in the manner provided by law, a Certificate of Convenience and Necessity authorizing the construction and operation of the necessary lines before any of the said construction work is undertaken. All construction work undertaken by corporations organized under this rule shall be done entirely in compliance with the Commission's General Order 30 establishing standards for overhead electrical construction. Any electric public utility who shall be requested to furnish wholesale electric service for such a corporation shall refuse to connect its circuits with the circuits of such corporation until these requirements of the rules have been complied with.

2. Rates to Other Utilities.

Electric public utility companies who shall furnish service to such rural corporations shall sell energy to them only at rates filed with and authorized by the Commission for the type of service to be rendered, provided that all terms and conditions precedent to the securing of such rates have been fulfilled by the rural corporation.

3. Rates to be Filed.

Such a corporation shall file with the Commission in compliance with the law a complete schedule of its rates and charges covering all classes of service to be rendered by it.

Class II—Those Consumers Who Have Formed a Mutual Organization

1. Standard Construction Required.

If the prospective rural consumers have formed a corporation, organization or association of a mutual character, for the purpose of operating without profit as set forth under class two above, any electric public utility which may agree to furnish service at wholesale to such mutual organization shall before connecting its circuits with the circuits of such mutual organization make certain that the character of the construction installed by such mutual organization will meet all requirements of the Commission's General Order 30 establishing standards for overhead electrical construction.

2. Rates to Mutual Organization.

The rates at which such mutual organization shall purchase energy must be only such duly authorized rates as the electric utility furnishing the service may have on file with the Commission for the class of service to be rendered.

3. Agreements for Construction and Operation of Property.

The construction, maintenance and operation of

the property of a mutual organization may be made the subject of an agreement between the electric utility company and the organization, which agreement shall be filed with the Commission by the utility furnishing the service in its regular rate file.

Class III—Those Consumers Receiving Service as Individuals

1. Ownership and Maintenance of Lines.

In the case of consumers receiving service as individuals the arrangements as to the construction and ownership of the necessary lines, transformers, lightning arresters, and other equipment, must be such that the title to the said lines and equipment, when completed, will rest in the electric public utility and that the electric public utility shall be responsible for their maintenance, operation and replacement.

2. Additional Consumers on Existing Lines.

It must be agreed between the utility furnishing the service and the consumers along any proposed distribution line, that additional consumers along the route of the said line or extensions thereof, shall receive service if applying for the same upon a non-discriminatory basis. If unable to agree the parties may appeal to the Commission which will render a decision upon the merits of the case.

3. Expense of Construction of Lines.

The proposed distribution circuits for the serving of the consumers covered by this class may be constructed at the expense of either the electric utility or the prospective consumers, as the rules filed by the electric utility in compliance with this order shall provide.

4. Lines Constructed at the Expense of the Utility.

If the distribution lines required are to be constructed at the expense of the utility furnishing the service such utility shall first secure in the manner provided by law a Certificate of Convenience and Necessity covering the construction and operation of the necessary lines, and the said construction must comply with the standards set forth in General Order 30 which provides standards for overhead electrical construction.

5. Lines Constructed at the Expense of the Consumer.

In case the construction is to be at the expense of the consumers, the actual construction work may be done either by the prospective consumers themselves or by the utility at the expense of the consumers, as the consumers may elect. In any case the actual construction work must be done in accordance with the rules laid down in the Commission's General Order 30 which provide standards for overhead electrical construction.

6. Combining of Service.

In case the individual consumer has on his own or adjoining premises owned by him, a number of buildings such as employes' houses, barns, etc., to which electric service is desired and the consumer

desires to receive this service over one meter, pay one service charge, and assume the responsibility for payment of the entire bill, the utility shall so furnish the service, provided the consumer is willing, at his own expense, to provide all construction necessary to connect the various buildings and to bring the common service to the building most conveniently located to the company's lines where the common meter may be placed.

7. Construction Work Done by Consumer.

In case the construction is to be done by the prospective consumers, the utility which is to furnish the service, before assuming ownership of the lines constructed as set forth in Rule 1, shall secure, in the manner provided by law, a Certificate of Convenience and necessity authorizing the utility to take over and operate the said lines.

8. Certificate of Convenience and Necessity.

Before the Certificate of Convenience and Necessity referred to in the foregoing rules is issued, the commission will require the filing of a plat showing the exact route of the lines and will require evidence that possible inductive interference with the lines of other wire using utilities has been considered and properly provided against, as set forth in Section II, Rules 204, 205, and 206 of General Order 30, as amended and adopted March 16, 1920. It is recommended that prospective consumers who expect to do their own construction work should make all the arrangements necessary and secure a written contract for the service (if required) from the public utility which is to furnish the service before any construction work is done. Upon the signing of the contract for service between prospective consumers and a utility, the utility must immediately apply to the Commission for the Certificate of Convenience and Necessity provided for in these rules.

9. Rates and Rules for Service to be Filed.

Before any electric public utility shall construct or extend distribution circuits into rural territory or connect its circuits to any distribution circuit for the purpose of serving individual consumers, such utility shall first file with the Commission as part of its rate schedule for each community from which such service is furnished, (or one schedule covering rural service to its entire territory in case the same rates and rules are to apply to the entire territory), and in accordance with the provisions of General Order 28, a statement of the terms and conditions under which such service will be rendered and the rates which shall apply to the service after these terms and conditions have been fulfilled. This statement shall contain the following items:

- a. A description of the general type or types of lines to be constructed.
- b. A statement of the proportion of the cost of construction of said lines and other equipment which the utility will bear.
- c. An explanation of the basis upon which additional consumers may be served from existing lines or extensions thereof.

10. Rates to Individual Rural Consumers.

For the purpose of rendering bills for electric

service furnished to individual consumers served under the provisions of the third section of this order, the utility shall file with the Commission a statement of the fundamental charges as hereinafter contemplated upon which the type of rates shall be based. All rates for service to individual rural consumers shall consist of a service charge in addition to the regular urban rates provided for hereinafter.

11. Service Charge.

The amount of the service charge shall represent the excess cost to the utility of furnishing the rural consumer with the class of service which he demands over the cost to the utility of furnishing the same service to a like consumer in urban territory, including such items as are ordinarily represented by the minimum bill.

12. Uniformity of Service Charge.

The service charge to each consumer on the same line shall be identical except such portion of the service charge as may vary between individual consumers on account of the difference in size and cost of their transformer and meter installation. The service charge to consumers on different lines may vary as the expense to the utility of furnishing service over the different lines shall vary.

13. Rate for Energy Used.

The rate for the energy used by individual consumers shall be the same rate including demand charges, if any, as charged to consumers demanding the same class of service in the municipality from which the service is furnished. The items ordinarily covered by the minimum bill in urban service are included in the service charge provided for in Rule II.

14. Municipality From Which Service is Furnished.

In the case of lines extended from a municipality where service is furnished, into rural districts solely for the purpose of furnishing energy to rural consumers along the routes of said lines, the service shall be deemed to be furnished from the municipality from which said lines are extended. In case distribution lines are constructed from a transmission line extending between municipalities, for the sole purpose of furnishing electric service to rural consumers located along the route of such distribution line, the service shall be deemed to be furnished from the municipality located nearest to the junction of the main transmission line and the rural extension, as measured along the main transmission line. In case individual rural consumers are connected directly to a transmission line between municipalities, the service shall be deemed to be furnished from the municipality nearest the point at which the connection is made to the main transmission line for the consumer's service, as measured along the main transmission line.

15. Meter Readings.

The Commission recommends that the rules provide for the reading of meters at not less than three (3) months' intervals but that provision be made for billing the service charge in monthly installments. This recommendation, however, shall

REPORT OF THE RURAL LINES COMMITTEE

not prevent utilities from securing readings of the meters of rural consumers at less intervals than three (3) months if they so desire, or if special conditions surrounding the service make the same necessary.

16. Type of Equipment on Rural Lines.

It is strongly recommended that all utilities furnishing service to rural consumers should adopt as standard equipment for the furnishing of this service the most modern devices of this nature which can be secured. Devices should be used which have as the controlling factor of their design the possibility of the consumer taking care of ordinary interruptions of service, i. e., such devices as are constructed to enable the consumer to safely remove and replace burned out fuses and other small operations of this nature. It is also recommended that the utilities should devote some time

to instructing their rural consumers in the operations of removing and replacing fuses and locating all ordinary sources of trouble and interruption to the end that the service furnished these consumers may be of the most continuous and satisfactory character, and rendered with the least possible expense to the consumer for maintenance charges.

Saving Clause.

The adoption of these rules shall in no way prevent the Commission from considering any case of a demand for service which may be brought to its attention upon its own merits, nor shall it in any way preclude the Commission from altering, modifying or amending these rules from time to time as may be necessary or advisable.

Adopted by the Commission December 8, 1920.
Effective January 1, 1921.

APPENDIX 3

Complete Report of Rural Line Committee of Ohio Electric Light Association

Electric service for the farm has come whether the electric company wishes it or not. The adaptability of electricity to lessen the burdens incident to farm life and the recognition of the farmer that central station service is vastly cheaper and more reliable than the isolated plant has brought him to the central station, insisting upon service upon any terms that are reasonable and fair. He is not asking for this service for less than cost plus a fair profit, but is wholly ignorant of the problems that enter into this service and that differ materially from the service in a municipality. Some central station men know but little more than the farmer regarding these problems and it is the desire of this committee to set out the ways in which this service differs from urban service and establish a firm and strong foundation upon which this business can be built, and one that will lead to a large and satisfactory business to both the farmer, public, and the electric company. This business is bound to become a large one, and within ten years we may expect electric service lines in the country to be as plenty as the telephone lines are today. The problems which are peculiar to the business, and which must be reckoned with by both the customer and the company can be summed up as follows:

1. Construction of lines and large cost per customer.
2. The small demand and consumption of the farm customer.
3. The voltage and phase necessary in making this distribution.
4. Maintenance of lines and their accessories and lightning protection.
5. Method of charging for service.
6. Contribution of the farmer to the original cost of line and contribution to be paid by subsequent users coming on such lines when living along the same and joining at the ends and from latterly lines.
7. Time limit of such contributions.

Construction of Lines and Cost

Owing to the distance between consumers the cost per customer is greatly in excess of that required in a municipality. It is rare that a greater number than five customers to the mile can be averaged in most lines. The actual bare bones cost of these lines in Ohio, not counting any engineering or overhead cost, will range from \$700 to \$1,000 per mile, depending upon the voltage. Owing to the small consumption of current by the farmer, the electric company cannot afford to have any investment in these lines. And we recommend that no company contribute any part of the cost of these lines.

Contrary to the popular idea, the farmer has a very small use for power over that needed and used in the cities. His household requirements are the same, and the use he has for large power is so in-

frequent that it would not pay him to maintain the equipment or pay the fixed charges necessary in providing for electric service of several horsepower. His uses for large power can be summed up in three items: Cutting ensilage, thrashing grain, and grinding feed. The first is done in about three days each year, and the second one day each year, and the third in one-half day each month, and he can use his farm tractor for this last use much cheaper and with less trouble. With these uses for larger power eliminated, his use for all other requirements is similar to that found in the towns and with a demand of less than one kw. at all times. To meet this single-phase service only is required, and this is desirable from the electric companies' standpoint so that transformer losses can be kept at the minimum. Owing to the distance between customers it is generally necessary to install a transformer for every customer, and with the small consumption transformer losses must be carefully considered, for in many instances they will be more than the consumption. We recommend the specifications covering the construction of farm lines be provided by the electric company that is to serve them. In general, we recommend that nothing less than 25 poles, 6 inch top, be used, white cedar in all cases. Number 6 bare copper wire and stranded where crossing railroads or main telephone lines. Washington fir crossarms, locust pins, standard construction, to be used in all cases.

Voltage

We recommend that 6,600 volts be used as the standard. While a great many 2,300 volt lines are in use and giving satisfactory service, the growing demand for this service will necessitate lines that will be too long for satisfactory service on the lower voltage. While with 6,600 volts most of the country territory in Ohio can be reached and satisfactory service rendered.

Maintenance

While we strongly recommend that no company invest any capital in these farm lines, we also recommend that the electric company maintain them. This is necessary from the standpoint of service and control. The cost of this service will be covered under the head of "Methods of Charging." If the farmers undertake to maintain these lines there is sure to be trouble. They are not in a position to furnish the necessary skilled help and their organization is generally so faulty that it will not function when repairs are needed to keep the lines even in a safe condition.

Lightning Protection

Owing to the liability of injury to transformers from lightning on country lines, we recommend that lightning arresters be installed at each transformer.

Methods for Charging for Service and Eenergy

As we have before set out, farm service carries

with its cost and burdens that are not found in town service. The extra costs can be summed up in the following items:

- Extra transformer losses per customer.
- Extra line losses.
- The maintenance of lines per customer.
- The cost of reading meters.

We recommend that these items of cost be taken care of by a fixed charge per month per customer, plus an energy charge for the current used. Some companies are seeking to take care of this by a larger minimum charge. This method, however, is not fair to the small consumer as the price that he will pay is very much higher per kw. consumed than the larger user. With the fixed charge method each customer pays alike on costs that are alike, and each pays the same per kw. consumer. We do not attempt to say what this charge should be. Each company should work this item out for themselves. We suggest the following be the standard used in determining these charges. Transformer and line losses to be charged for at cost of current at the transformer.

Maintenance at 3 per cent per annum if transformers are maintained by the customers: 5 per cent if maintained by the electric company. Extra cost of reading meters 5 cents per month per customer. For the energy charge we recommend that a rate with steps downward from the maximum be used, so as to encourage use of ranges and appliances in farm service. We strongly condemn any method of wholesaling electric current to the farm companies or groups of individuals. Electric service has so many complicated problems that are different from any other business that such method of selling service will lead to trouble, misunderstandings and unprofitable business relations.

Contribution Among Customers for Construction of Lines

The farmer having to provide these lines for their service it becomes necessary that he should be provided with a workable plan whereby a number can construct such line and be protected in the case of subsequent customers living along and coming on such line after it is built and paid for.

Lines will usually be built in sections, that is, one group of farmers will construct a line along a certain highway: later another line will be projected further on or latterly from the original line. It is important that these lines, the original as well as the subsequent, be uniform in construction as well as the builders, friendly in their relations. Farmers

usually are at a loss how to proceed with their building agreement. Knowing the original cost of a line, it is not hard to arrive at what a subsequent customer living along and coming on such line should pay. The rule as laid down by many of the commissions is that the contribution to be paid to the original builders shall be such amount as shall keep at all times the equilibrium of amounts invested, or so that all living along and using such line contribute equally to its cost. Any other plan makes the group a utility in that some would be making a profit from the others. What contribution subsequent users extending such line further on the same highway or coming on such line from a lateral highway should pay is a much more difficult problem. The assumption is that those so coming on the original line will have to pay as much per mile in their construction as the original builders did for theirs, and therefore should contribute nothing to the original builders. This should be the rule followed. We find, however, that some companies have followed the practice of fixing these contributions at one tap payment for a lateral tap, no contribution for an end tap, and some have provided for one payment for an end tap and one for a lateral tap. We believe that the better practice is for no payment for such taps on the original line.

Time Limit

Contributions toward the original cost to the original builders from those living along such line should have some limit in time and we recommend that five years be the limit to require such payments. This time should be long enough to prevent farmers from holding out on original construction in order to get on for nothing. At the same time it should not be so long as to be a nuisance in keeping the account and remitting to original builders. Experience has shown that this matter of contribution from subsequent customers living along a line is not as serious as it looks, as most groups get their territory well saturated before they build the line.

The above report is based upon the conditions as they exist throughout Ohio, where generally the farms are small and highways frequent and where diversified farming is practiced. Slight changes will have to be made to meet local conditions. We call attention to the recent enactment of a law by the legislature, which gives township trustees the right to make ten-year contracts for lighting highways in the township. This opens up a field that may give additional income from the farm lines.

APPENDIX 4

Indiana Public Service Commission's Rules for Rural Service Extensions

(a) Definition

A rural consumer is one whose premises are without the corporate limits of a municipality and one requiring an investment per consumer's unit demand greater than is ordinarily required for consumers within municipalities.

(b) Cost of Service

Rural consumers may have electric service, provided they will compensate the utility for the fixed and operating costs of the service.

(c) Rates

Rates must not be discriminatory and because greater investment is required per rural consumer's unit demand and greater line loss is suffered in rural distribution than with municipal consumers, the rates should be higher for rural service than for service in the utility municipal area. All consumers must bear their fair share of the utility's expenses some of which may be enumerated as follows:

- Interest on investment
- Depreciation
- Taxes
- Insurance
- General Office and Officers' Expenses
- Operating Labor and Supplies
- Maintenance
- Coal
- Meter Reading, Accounting and Collecting, etc.

(d) Form of Rate

The rate shall consist of two parts

- (1) A "minimum bill" to partially cover the fixed charges.
- (2) An "energy charge" to cover the operating costs of generating, transmitting and distributing the electric current.

(e) New Consumer

A new consumer proposing to take service from an extension paid for by a group of consumers shall share in the cost of the extension.

(f) Guarantee

The utility may require of the prospective consumer a satisfactory guarantee that he will fulfill all the obligations made by him to the utility.

(g) Safety

Safety in construction and maintenance is essential. Divided ownership and responsibility are not good public policy and the construction of electric lines by inexperienced persons or companies is discouraged.

(h) Acquisition of Lines

To the end that safety and uniformity may be obtained in the rehabilitation and maintenance of electric lines the utility may acquire lines owned and constructed by others.

APPENDIX 5

Form No. C 388

CORPORATION RURAL ELECTRIC SERVICE CONTRACT

MEMORANDUM OF AGREEMENT made in duplicate this day of , A. D. 192 ,
by and between the IOWA RAILWAY AND LIGHT COMPANY, an Iowa Corporation hereinafter called the
"PRODUCER," and the COMPANY,
an Iowa Corporation, hereinafter called the "CONSUMER,"

WITNESSETH: That for and in consideration of the agreements of the parties hereto, hereinafter set forth, and the performance of said agreements, it is mutually understood and agreed by and between said parties as follows:

1. The CONSUMER shall provide a volt, phase, cycle rural distribution system constructed in accordance with specifications furnished by the Board of Railroad Commissioners of the State of Iowa or other legally authorized body or, in the event specifications have not been provided by any such legally authorized body, in accordance with specifications furnished by the PRODUCER. Said distribution system shall begin at

and shall be confined to the following territory, to-wit:

The CONSUMER shall furnish the PRODUCER with an accurate map of the said distribution system and all extensions made thereto. If, in the judgment of the PRODUCER, the construction of said distribution system is not in accordance with the specifications, the PRODUCER may refuse to make connection with said distribution system until the construction complies with the specifications, or the PRODUCER has been ordered to make connection by the said Railroad Commission or other legally authorized body.

2. The PRODUCER shall maintain and operate the said rural distribution system and the CONSUMER shall pay the PRODUCER for the service of said maintenance and operation the schedule of charges filed in the office of the manager of the division in which the CONSUMER is located. The CONSUMER shall make payment for the service of maintenance and operation within ten days after rendition of a bill therefor.

3. The PRODUCER shall, except during construction, protect, defend and indemnify the CONSUMER against any and all claims for damages growing out of the maintenance, operation and ownership of said distribution system, provided the CONSUMER gives by telephone immediate notice of all accidents to the Division Office of the PRODUCER followed by personal or written notice with fullest information obtainable. All claims for said damages shall be forwarded immediately to the office of the General Manager of the PRODUCER at Cedar Rapids, Iowa. The CONSUMER shall forward to the PRODUCER every summons or other process served upon it in any suit, however groundless, on account of any claim. The CONSUMER shall, except in a pecuniary way, render to the PRODUCER all reasonable co-operation and assistance in the protection by the PRODUCER of its or the CONSUMER'S interests. The CONSUMER shall pay in advance

REPORT OF THE RURAL LINES COMMITTEE

for the first year of this agreement the sum of \$ _____ for each customer of the CONSUMER, and annually in advance thereafter the sum found necessary for said protection.

4. The PRODUCER shall use due diligence and exert every reasonable effort to provide uninterrupted service, but shall not be liable for damages resulting from interruptions of service.

5. The PRODUCER shall furnish electric service, and the CONSUMER shall use and pay for such service, in accordance with the terms and conditions of this agreement and the Rules, Regulations and Charges of the PRODUCER. The Rules, Regulations and Charges effective at the date of this contract are as given in Exhibit "A" attached hereto and made a part hereof.

6. Electric Service purchased under this contract is not for resale except to consumers within the territory defined in Section One hereof. The CONSUMER shall at all times give all residents within the district specified in Section One hereof, an opportunity to purchase electric service on terms substantially equivalent to those given to others served by the CONSUMER.

7. If the CONSUMER shall elect to sell its farm line distribution system, the PRODUCER shall be given the first opportunity to purchase same at and for the purchase price at which the CONSUMER is willing to sell to any other buyer.

8. The failure of either of the parties hereto to enforce, from time to time, the strict performance of any of the covenants and agreements herein contained, or the waiving, from time to time, of a default on the part of either of the parties hereto shall not be construed as a waiver of any continuing or subsequent default or defaults nor impair the right of either of the parties hereto to subsequently require the strict performance of each and every covenant, agreement and undertaking herein contained.

9. The CONSUMER shall secure permission for the PRODUCER to do the necessary pruning of trees along the right-of-way of the rural distribution system and to do other things essential to the efficient and safe operation of the said rural distribution system.

10. It is understood that wherever a written request or written notice is specified in this contract, such request or notice shall be signed by an official of the CONSUMER and mailed or delivered personally to the manager of the district within which the rural distribution system is located or from such local manager or an official of the PRODUCER to the secretary of the CONSUMER as the case may be.

11. The Rules, Regulations and Charges of the PRODUCER, affecting the CONSUMER, may be revised by mutual consent of both parties. In the event that either party has, by written notice, requested a revision of said Rules, Regulations and Charges, and such revision has not been affected by mutual agreement within sixty (60) days after the date of said written notice, either party may submit the matter to any legally authorized body, as provided in Article 12, or in the absence of such body, either party may bring an action in equity in any Court having the proper jurisdiction.

12. The foregoing terms and conditions of this agreement and the Rules, Regulations and Charges of the PRODUCER shall be subject to revision by any legally authorized body which may be given jurisdiction thereover by the State of Iowa.

13. This agreement shall continue for a period of fifteen (15) years commencing the day of _____ 192 _____ and ending on the _____ day of _____ 19 _____

This agreement shall be binding upon the parties hereto only after its execution by a General Officer of each party.

Signed in duplicate this _____ day of _____ 192 _____

IOWA RAILWAY AND LIGHT COMPANY

Attest: _____
Secretary

By _____

Attest: _____
Secretary

By _____

Form No. C 388 a

EXHIBIT "A"

Rate No. 65

Attached to and forming part of Corporation Rural Electric Service Contract Form No. C 388 dated 192 for the Line.

An Energy Base Rate of two and one-half (2.5) cents for all electricity used per month PLUS

A Monthly Demand Charge of five dollars (\$5.00) per kilovolt ampere of demand PLUS

A Monthly Service Charge of Dollars (\$)).

The Energy Base Rates will be increased or decreased beginning with January 1st and July 1st of each year for the next six months period at the rate of one mill per kilowatt hour for each thirty (30) cents or major portion thereof variation above or below five and 50/100 dollars (\$5.50) per ton for the cost of coal burned in the previous six months period. The cost of coal burned to include all the costs that are chargeable to the accounts of Fuel, Boiler Room Labor and Water for Power at the , Iowa. Power Plant.

The Monthly Demand shall be the highest average number of kilovolt amperes recorded in a fifteen minute period during the month, unless said monthly demand is less than seventy-five per cent of the highest monthly demand established during the preceding twelve months, in which event the monthly demand shall be seventy-five per cent of such preceding highest monthly demand.

RULES AND REGULATIONS

1. Installation and Maintenance

All wiring, equipment and apparatus must be installed and maintained in accordance with the legally authorized code.

2. Protection of Service

CONSUMERS shall not use the PRODUCER'S service for operating wireless equipment or other equipment that will affect the service of the PRODUCER, without complying with the PRODUCER'S rules governing such equipment.

3. Correcting Meter Errors

In case the master watt hour meter is found to be incorrect by more than 2% plus or minus, the consumption for the two billing months preceding the test shall be adjusted to conform to the correct amount based on said test.

4. Stopped Meters

Should a meter fail to register during all or part of a month, the bill for the month shall be calculated equitably from the previous or succeeding month, or from known load and hours of consumption.

5. Reading Meters

The PRODUCER will read the master meters on or about the same day each calendar month.

6. Rendition of Bills

The PRODUCER will render a bill or bills to the CONSUMER for electricity and such other services as may be due the PRODUCER on or about the same day of each calendar month. Rendition of a bill shall be the mailing or delivery of the bills to the address designated by the CONSUMER.

7. Non-Payment of Bills

In the event that a CONSUMER has not paid all of the money due the PRODUCER for Electric Service within ten days after rendition of a bill or bills, the amount due shall be increased by 10%. If said bill or bills plus the 10% increase is not paid within 20 days after rendition, the PRODUCER reserves the right to discontinue service until all amounts in arrears are paid in full.

8. Continuity of Service

The PRODUCER will use due diligence to furnish continuous and uninterrupted service but the PRODUCER shall not be liable for damages caused by any interruptions of service.

9. Deposits

The CONSUMER may be required to deposit with the PRODUCER an amount equal to two average months' bills. Interest will be allowed on such deposit at the rate of 7% per annum.

APPENDIX 6

Rules of the Northwest Geographic Division for Lighting and Small Power Extensions

Scope of Rules

(a) The purpose of these rules is to establish a working formula for determining the amount which any electric utility, at the time in successful operation and reasonably able to finance itself can with due regard to the interests of existing consumers afford to invest in any requested extension of service of the character hereinafter mentioned and to determine under what conditions such an extension may be required and such service supplied where the investment necessary therefor is greater than the amount permitted under the application of such formula. However, it will be apparent that conditions will frequently exist where, by reason of inadequate earnings, financial stringency or other causes, any particular utility may not be able to secure the new capital required for extensions or improvements otherwise reasonable and desirable, as to which utilities under such circumstances, upon proper showing to the commission, these rules shall not be applicable.

(b) These rules are intended to apply to all of the operating territory of any electric utility, but if in any district of such utility's territory, the application of these rules would prove prejudicial to the best interests of existing consumers and of such utility, these rules may be modified or deviated from with the approval of the commission in the manner as will fairly meet the conditions in such district.

(c) The rules apply to extensions built along highways or streets over which company has franchises or rights of way which are capable of further extension developments or upon property over which adequate and permanent rights of way are tendered by the applicant for the extensions.

(d) The rules apply to extensions for supplying lighting and small power business which is permanent and not for supplying temporary business.

Rules

1. Extension Defined

A line extension is defined as a branch from or continuation of an existing primary or secondary distribution circuit, or both to serve new business.

A line extension includes all labor, materials and apparatus used in the line extension up to the customer's service outlets and includes the meter.

A line extension may consist of poles, wire, transformers, and other materials and apparatus, or it may consist of only one or more wires on existing poles.

That part of the cost of increasing the capacity of existing lines and apparatus and that part of the cost of overbuilding of secondary lines with primary lines, which is made necessary by an extension, shall be considered a part of the cost of such line extension.

A primary or secondary distribution circuit should not be confused with a transmission circuit

used *primarily* for the transmission of electric energy between generating stations, between substations or between generating stations and substations.

2. Cost of Extension Defined

Estimated construction cost shall include all material, labor and other expense required for the distribution and installation of poles, wire, cross-arms, insulators, line hardware, switching and protective devices, transformers, meters, appurtenances, right of way permits, etc.

An item not exceeding 10% of material cost shall be included to cover purchasing expense, cartage to storeroom and stores department expense.

An item not exceeding 15% of all above mentioned items shall be included to cover general overhead, engineering promotion, office supervision, clerical labor, contingencies, etc.

3. Distribution System Defined

The distribution system of any utility embraces all property of the utility carried in the following plant accounts of the uniform system of accounts for electric light and power utilities, prescribed by the Commission. These accounts are:

OREGON

- E216-C—Poles and Fixtures, Distribution System
- E217-C—Overhead Distribution System
- E218-C—Underground Distribution System
- E223 Line Transformers and Devices
- E224 Services
- E225 Meters
- E226 Municipal Street Lighting System
- E227 Commercial Lamps and Lamp Equipment

4. Analysis of Extension

When one or more prospective consumers make application for electric service the utility will investigate the extension, ascertain the number of consumers who can be advantageously served, the number who will contract for service under the terms herein prescribed and will estimate the construction cost as outlined in Rule 2, and will also estimate the annual revenue to be derived from the extension.

5. Basis of Utility's Investment

(a) Each utility will invest an amount of money to be determined as hereinafter provided for each dollar of estimated prospective annual revenue.

(b) The minimum amount to be invested by any utility in an extension will be the same amount per dollar of estimated prospective revenue of the new business, as the utility already has invested in distribution system within that operating territory per dollar of revenue derived from that system, which will hereinafter be called the Minimum Investment Ratio for that Utility in that territory. Each utility will file annually with the Commission its Minimum Investment Ratio for each separate operating terri-

tory, but such Minimum Investment Ratio shall in no case be less than one dollar and twenty-five cents to one dollar of revenue.

(c) Each utility may, at its option, divide its operating territory or territories into districts, for each of which it will file with the Commission a yearly schedule setting forth respective investment ratios to which it will adhere for the ensuing year in each district. These ratios may be greater than the minimum prescribed in (b) but not less.

6. Conditions to Be Met by Consumers

(a) As a condition precedent to the building of any extension under these rules, the utility may require from the prospective consumer the execution of a contract with the utility for service over a period of years up to the length of the development period hereinafter referred to.

(b) If the estimated cost of such proposed extension is in excess of the amount which the utility can afford to invest therein in accordance with its filed schedule and such cost is not greater than five times the estimated annual revenue therefrom, the prospective consumer or consumers may nevertheless secure the building and operation of such extension by the utility by first paying to the utility an amount of money to be computed as hereinafter provided, sufficient to make good the deficit which would otherwise be incurred by the utility by reason of the construction and operation of such extension during the "development period" hereinafter defined. The amount of such deficit and of the payment to be made by the customer on account thereof shall be determined in the following manner:

During the first year after the construction and operation of such extension the deficit incurred in that year by reason of the excess cost of such extension will be an amount which is the sum of the following percentages applied to such excess cost:

Return A%
Taxes B%
Depreciation C%
Operation D%
Risk and Contingencies E%

A% to be the current annual average cost of new capital to the utility from time to time.

B% to be the prevailing tax rate on actual value in the district in which the extension is made.

C% to be the average rate of depreciation of the distribution system.

D% to be the ratio of the total of the utility's distribution, utilization, and commercial expenses to the value of the distribution system as a whole in the territory.

E% to be 2% to cover risks and contingencies.

It is assumed that there will be a gradual increase in business and revenues from such extension over the development period hereinafter defined, so that the amount of the annual deficit will gradually decrease over such development period, and will

average each year for an extension one-half of said first year's deficit computed by the application of the foregoing percentages to the excess cost. The amount therefore necessary to make good the deficit incurred by reason of such excessive investment in and the operation of such extension, shall be the sum of such average annual deficits for the number of years of the development period discounted on a four per cent compound interest basis, and such sum when so paid shall entitle the prospective customer to have such extension constructed and operated by the utility.

For convenience of reference there is given below a table for use in making the necessary calculations:

Compound Discount Table

Showing amount of present payment necessary in order to produce \$1.00 per year for any number of years up to 20, calculation being made on a 4 per cent compound interest basis.

Development period years	Amount Present Payment	Development period years	Amount Present Payment
1.....	\$.962	11.....	\$ 8.76
2.....	1.886	12.....	9.385
3.....	2.775	13.....	9.985
4.....	3.63	14.....	10.563
5.....	4.452	15.....	11.118
6.....	5.242	16.....	11.652
7.....	6.002	17.....	12.166
8.....	6.733	18.....	12.659
9.....	7.435	19.....	13.134
10.....	8.111	20.....	13.59

Illustration: Assume an estimated average deficit of \$10 per year and a development period of 10 years. By consulting the table it will be found that the amount necessary to pay \$1.00 per year for 10 years is \$8.111, which multiplied by \$10, the amount of the average deficit, will be \$81.11, which would be the amount of the consumer's payment to make good such deficit.

(c) By development period is meant the estimated period of time required for an extension to become self-supporting. An extension is considered to be self-supporting when its ratio of investment to revenue equals the investment ratio filed by the utility for the district in which the extension is located.

Each utility may file with the Commission a yearly schedule setting forth the respective development period for each district established by it in accordance with the provisions of 5 (c) above. The development period for each district may be checked annually by the utility and when necessary adjusted to conform to the average rate of growth of gross revenues which has obtained for all extensions in each district, but such adjusted Development Period when so made and filed shall relate to and affect only extensions thereafter to be made.

7. Rates

The rates applying under these rules shall be the tariffs filed with the Commission applicable to the class of business.

8. Utility to Own Extension—No Refunds

Since the extension is to be financed by the utility the title to the same will remain with the utility building it; also since the amount paid by any prospective customer on account of the deficit resulting from the construction and operation of

any extension, will with similar payments made by other prospective customers be only sufficient on the average to make good the actual deficits resulting from the construction and operation of such extensions, no such customer shall be entitled to a refund of any amount so paid by him.

